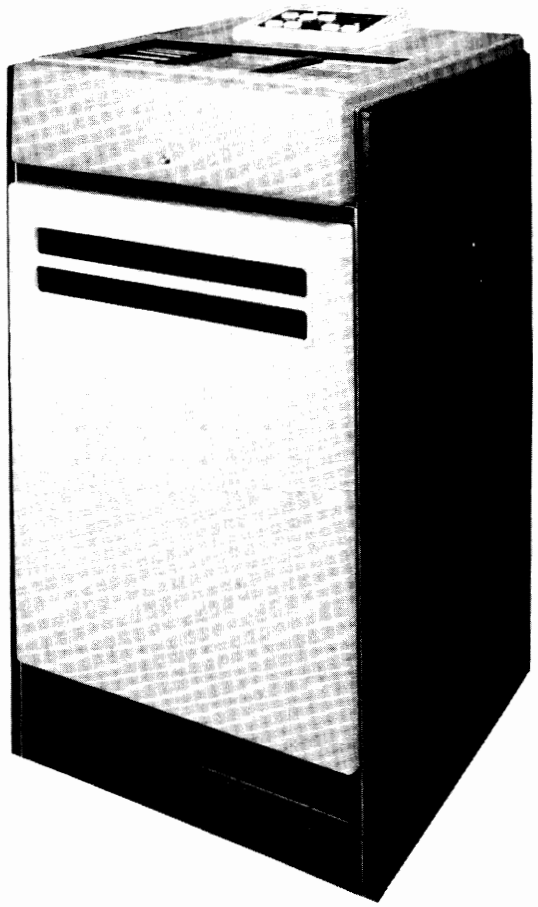
NCR 636—201/301 CASSETTE HANDLER



The NCR 636-201/301 Cassette Handler is an NCR Century common trunk peripheral that is used to read and write data from and to magnetic tape cassettes, providing direct file compatibility between the NCR Century and those products in the NCR line that use magnetic tape cassettes (such as the 399, the 270, the 280, etc.). The 636-201 unit consists of a controller and two cassette handlers in a low-profile cabinet; the 636-301 unit consists of either one or, optionally, two cassette handlers. Each cassette unit is connected to a single position on the common trunk; each cassette handler, however, has its own unique unit location. The control word, which is assigned to the cassette unit, must be shared by both handlers. The normal NCR Century magnetic tape software is used to drive the 636 Cassette unit; therefore, the existing magnetic tape utility routines (TINIT, GAC, MTPRNT, CPYALT, etc.) may be used with the cassette. Special programming considerations are dealt with in the NEAT/3 Manual, FILES, Tab 2, "NCR Century Cassette Files".

TABLE OF CONTENTS

PHYSICAL DESCRIPTION 3
The 636-201 Cassette Unit 3
The 636-201 Control Panel 3
The 636-301 Cassette Unit 4
The 636-301 Control Panel 5
The Cassette Cartridge 5

FUNCTIONAL DESCRIPTION 6
The Peripheral Address Field 7
Position 7
Unit 7
Function 7
Selection 8
Data Transfer 9
Read Operation 9
Write Operation 9
Termination 10

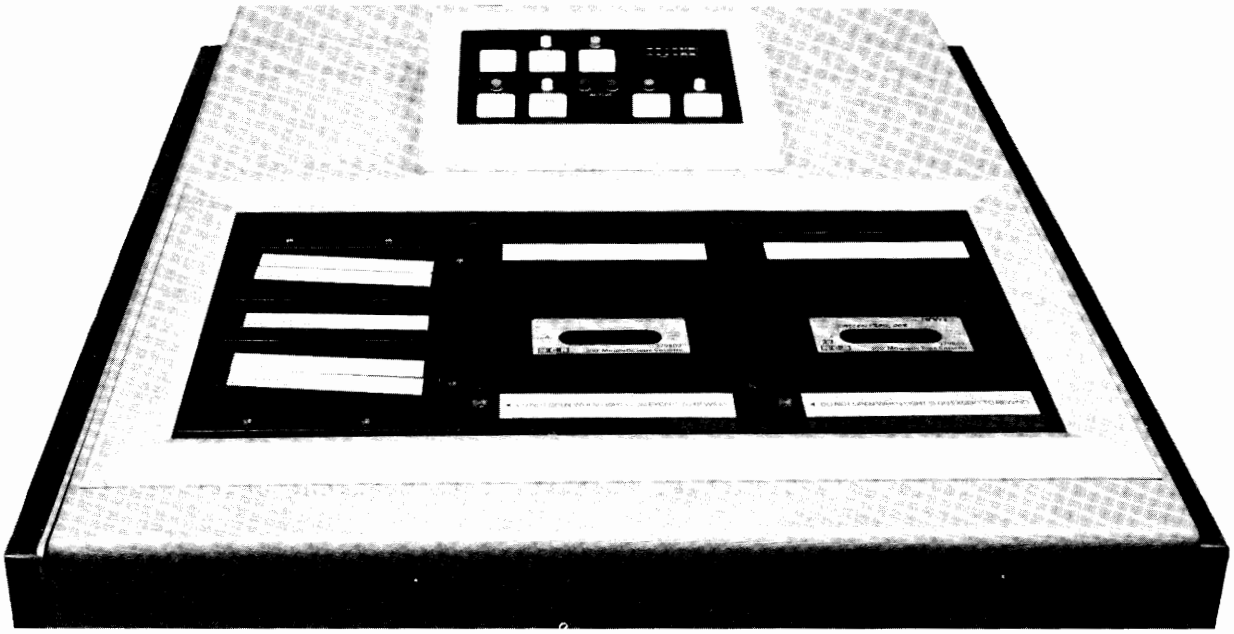
OPERATION 11

SPECIFICATIONS 12

PHYSICAL DESCRIPTION

The 636-201 Cassette Unit

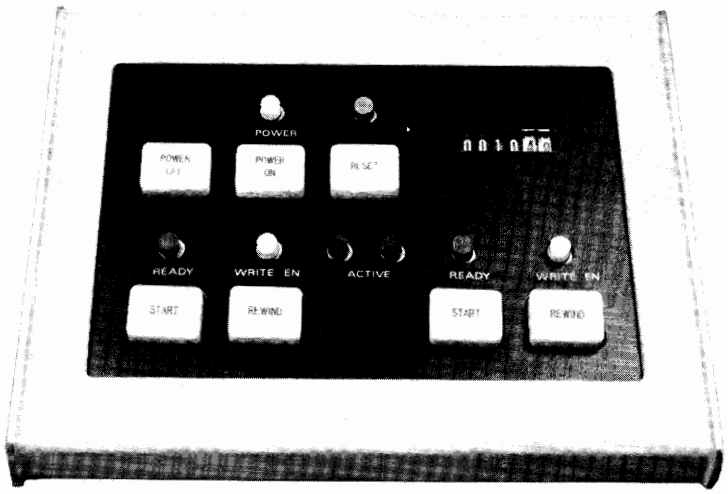
The 636-201 Cassette unit contains one cassette handler located in the center and a second cassette handler on the right. On the left is a storage compartment for up to ten cassette cartridges.



The 636-201 Cassette unit is 24 inches wide, 28 inches deep, 44 inches high, and weighs 500 pounds.

The 636-201 Control Panel

The control panel contains the POWER ON, POWER OFF, and RESET switches for the unit, and separate START and REWIND switches for each cassette handler.



Pressing the ON switch applies power to the unit, clears all circuits to a reset state, starts power up-sequencing, and illuminates the POWER indicator. When power is applied, an automatic rewind is executed by each cassette handler.

Pressing the OFF switch removes power from the cassette unit and turns off the POWER indicator.

The RESET switch, if pressed when the peripheral is not selected, clears all circuits to a reset state, placing each cassette handler in the not-ready state. The RESET switch, if pressed when the peripheral is selected, terminates the function being executed, placing each cassette handler in the not-ready state.

Pressing the START switch places the associated cassette handler in a ready state, assuming that power is on and no error conditions exist. In the ready state, selection of the unit can take place.

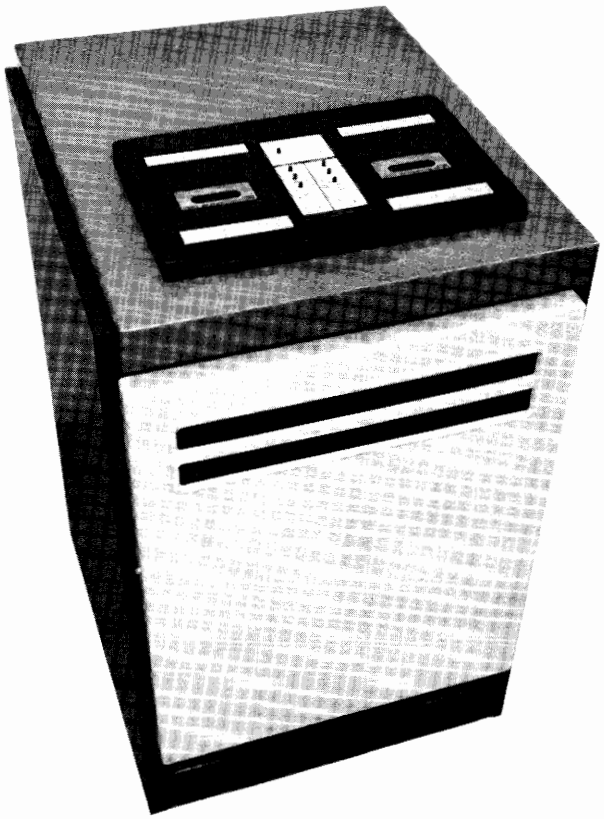
Pressing the REWIND switch places the associated cassette handler in the not-ready state and initiates a rewind operation. This control can be activated when the cassette unit is deselected.

The READY indicator is illuminated when the corresponding cassette handler is ready for selection by the processor.

The WRITE ENABLE indicator is illuminated when the write-enable plug is positioned to permit writing to the associated cassette tape.

The ACTIVE indicator is illuminated whenever tape movement occurs in the associated cassette handler.

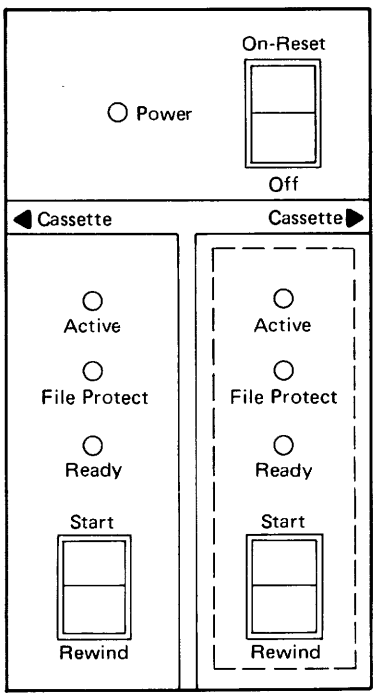
The 636-301 Cassette Unit



The 636-301 Cassette unit contains one cassette handler, located to the left of the centered control panel. Optionally, a second cassette handler may be included in the unit, located to the right of the control panel. The START/REWIND switch and the indicator lights on the right side of the control panel are included with the optional handler; with a single handler, the right side of the control panel is covered with a blank plate.

The 636-301 Cassette unit is 24 inches wide, 28 inches deep, 44 inches high, and weighs 187 pounds.

The 636-301 Control Panel



The control panel contains a combined POWER ON/OFF-RESET switch for the unit, and a combined START/REWIND switch for each cassette handler.

The POWER ON/OFF-RESET switch is a three-position switch. The middle position is the neutral home position. Pressing the switch initially to the ON position (up) applies power to the unit, clears all circuits to a reset state, starts power up-sequencing, illuminates the POWER indicator, and initiates an automatic rewind by each cassette handler. The control deactivates after the initial depression to the ON position. Subsequently pressing the switch performs a RESET function.

The RESET function, if the switch is pressed when the peripheral is not selected, clears all circuits to a reset state, placing each cassette handler in the not-ready state. The RESET switch, if pressed when the peripheral is selected, has no function.

Pressing the ON/OFF-RESET switch to the OFF position (down) removes power from the cassette unit and turns off the POWER indicator.

The START/REWIND switch for each cassette handler is a three-position switch, with the middle position being the neutral home position. Pressing the switch to the START position (up) places the associated cassette handler in the ready state, assuming that power is on and no error conditions exist. In the ready state, selection of the unit can take place.

Pressing the switch to the REWIND position (down) places the associated cassette handler in the not-ready state and initiates a rewind operation. This control can be activated when the cassette unit is deselected.

The READY indicator is illuminated when the corresponding cassette handler is ready for selection by the processor.

The FILE PROTECT indicator is illuminated when the file-protect plug is removed to prevent writing to the associated cassette tape.

The ACTIVE indicator is illuminated whenever tape movement occurs in the associated cassette handler.

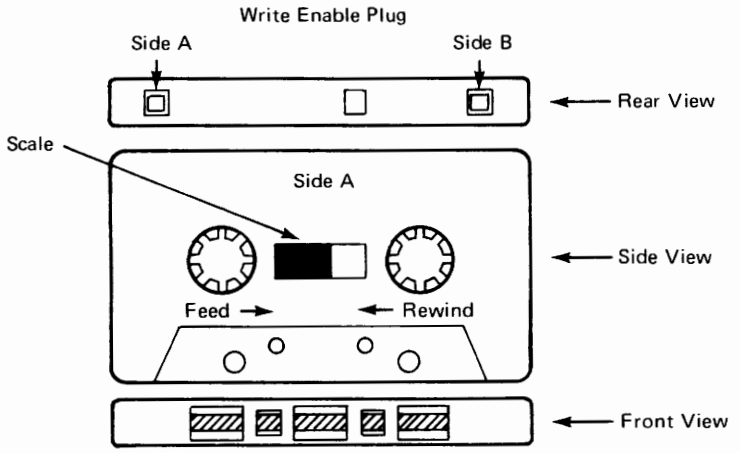
The Cassette Cartridge

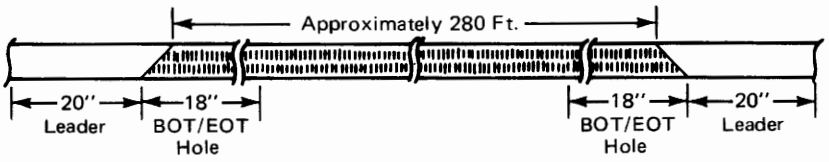
Tape cassettes contain approximately 280 feet of tape that is coated on one side and that contains two parallel recording tracks (although only one track can be accessed at a time). Cassette cartridges are marked "Side A" and "Side B"; to record or read on track 1 the cartridge must be installed in the cassette handler with "Side A" visible, and to record or read on track 2 the cartridge must be installed with "Side B" visible. Space is provided on each side

of the cassette cartridge to allow a handwritten description of the contents of the associated track to be made.

A scale marked between the reel hubs on each side of the cassette indicates the number of feet of tape remaining on the supply reel. This scale is calibrated either from 0 to 300 (in 50-ft. increments) to indicate length, or from 0 to 100 to indicate the percentage of tape used. Data capacity is 2040 80-character blocks, or 984 256-character blocks per track (Side A or Side B).

A write-enable plug (or tag) for each track is located near each corner on the back edge of the cassette. When a cassette is locked into the handler, a spring-loaded sensor at the left-rear of the cartridge makes contact with the write-enable plug. With the plug in place, the track can be used for either recording or reading; when the plug is removed, the write function is disabled.





Holes are located on the centerline of the cassette tape, approximately eighteen inches from either end of the recordable portion. During tape motion (from left to right), the hole at the right end of the tape is recognized as the beginning-of-tape mark (BOT). The hole on the left end is recognized as the end-of-tape mark (EOT). Although approximately eighteen inches of recordable tape precede the BOT hole, reading or recording is not initiated until the BOT hole passes between the light source and the photoelectric sensor.

FUNCTIONAL DESCRIPTION

An I/O operation begins with the processor selecting the peripheral by means of executing the hardware INOUT command. The INOUT command is an 8-byte instruction that contains the address of the Peripheral Address Field and the address of the memory location in which the status of the I/O operation is to be stored.

INOUT COMMAND							
Q	RA	Address of PAF		T	RB	Address to Store S2 Status Character	
		A_2	A_1			B_2	B_1

The Peripheral Address Field

During execution of the INOUT command, the processor locates the Peripheral Address Field in memory which contains a series of characters that indicate the location of the cassette unit and the function it is to perform. The Peripheral Address Field for the 636 Cassette is a 3-byte field consisting of a position character, a unit character, and a function character.

PERIPHERAL ADDRESS FIELD		
Trunk & Position Character	Unit Character	Function Character

- Position

  The position character contains the trunk and position location of the cassette unit; this number corresponds to the trunk-and-position number that is wired into the cassette control logic. It is used by I/O Control to locate the cassette unit when it is to be selected.

- Unit

  Each cassette handler must be accessed individually; therefore, the cassette's Peripheral Address Field also contains a unit character that indicates which of the two handlers is being selected.

- Function

  The function character designates the type of operation to be performed (read, write, erase, backspace, rewind, rewind-and-set-notready, write-tape-mark, or recovery-read). The cassette unit's control logic initiates the function specified by the bit configuration of this character.

  - The READ function (0000 0001) and the RECOVERY READ function (0000 1001) cause the cassette to copy data from the cassette to memory via the common trunk. The number of characters copied is determined by the next-address (NA) and termination-address (TA) characters of the cassette unit's control word.

  - The WRITE function (0000 0010) causes the selected tape handler to copy data from memory, via the common trunk, to the cassette tape. The length of the record is determined by the contents of TA and NA in the cassette unit's control word.

  - The ERASE function (0000 0011) causes the cassette unit to erase for approximately three inches in the forward direction. A read check

determines if unerasable noise exists on the tape. The erase function terminates after approximately three inches of tape have been erased, and the appropriate status character is stored in the cassette unit's control word. If this function is issued when the tape has not yet reached the BOT mark, the erase operation continues three inches beyond the BOT mark.

- The BACKSPACE function (0000 0100) causes the tape to backspace over one physical record, so the read and write heads are positioned in the inter-record gap, ready to perform a subsequent function. The operation terminates after the last data character has passed and a status character has been stored.

- The REWIND function (0000 0101) causes the cassette to rewind the tape. After the rewind operation has been intiated, a status character is stored in the control word.

- The REWIND-AND-SET-NOTREADY function (0000 0110) causes the cassette control logic to rewind the tape and place the cassette in a not-ready state. After rewind has been initiated, the status character is stored in the cassette's control word.

- The WRITE-TAPE-MARK function (0000 0111) causes the tape mark to be written on tape; the cassette unit's control logic then terminates the function and stores the appropriate status character in the control word. (If this function code is issued when the tape is between the transparent leader and the BOT mark, the tape mark is written 1.3 inches after the BOT mark.)

Selection

The 636 Cassette unit selects itself when the location (trunk and position) to which it is assigned matches the location indicated by the Peripheral Address Field. If the trunk is not busy and the cassette unit is operational, the "command initiated" S2 status character is stored; the processor then terminates the INOUT command and places the cassette under the supervision of the processor's I/O Control. If the cassette does not respond within a specified length of time, the processor terminates the INOUT command and stores the appropriate S2 status character in the specified memory location; the system software then takes whatever corrective action is necessary.

The processor stores one of four S2 status characters to indicate the outcome of the selection attempt: BUSY, COMMAND-INITIATED, INOPERATIVE or RESPONSE-ERROR, and COMMAND-PARITY-ERROR.

- The COMMAND-INITIATED S2 status character (0100 0000) is stored after the processor has successfully selected the cassette unit and initiated the I/O operation. The I/O operation is then under the control of the cassette unit's control logic and the processor's I/O Control. After storing the S2 status character, the processor terminates the INOUT command.

- The BUSY S2 status character (1000 0000) means either that the I/O trunk is busy because another peripheral is active or that the cassette unit is busy, performing a function.

- The INOPERATIVE/RESPONSE ERROR S2 status character (0000 0010) is stored by the processor during selection if the cassette handler is in the not-ready state or if the cassette unit encounters an illegal function code. Both conditions cause the cassette unit to deselect. This status character is stored when (1) a READ or RECOVERY READ function code is issued following a WRITE, ERASE, or WRITE-TAPE-MARK function; (2) an attempt is made to select a cassette unit not connected to the trunk or not powered up; or (3) the cassette handler cannot be selected because of a controller malfunction.

- The COMMAND-PARITY-ERROR S2 status character (1010 0011) is issued if the cassette unit detects a parity error on control information transmitted by the NCR Century 101, 151, 251, or 300 processor.

Data Transfer

When the cassette unit's control logic is ready to receive or transmit data, it sends the cassette's response number to the processor's I/O Control, which uses the response number to locate the cassette unit's control word in memory. The control word is an 8-byte field that is used to (1) indicate the beginning address of the cassette's buffer in memory, (2) indicate the ending address of the same buffer, and (3) store the terminating status character.

CONTROL WORD						
S3 or S4	NA			TA		Activity Pointer
	N_3	N_2	N_1	T_2	T_1	

- Read Operation

  Data is read from the tape and transmitted to memory via the common trunk. The number of characters read is determined by the NA-TA characters of the cassette unit's control word.

  If the number of characters specified by the INOUT command exceeds the number of characters contained in the physical record on tape, the function terminates after the last character on the tape has been read and verified, and the appropriate status character is stored in the cassette unit's control word. If the physical record on tape is larger than the number of characters specified in the control word, data input ceases when NA = TA; the function terminates after the last character has been read and verified, and the appropriate status character is stored in the cassette unit's control word.

  If the last function performed on this cassette was a WRITE, ERASE, or WRITE-TAPE-MARK, the READ function is aborted and a "Response Error" status is recorded.

- Write Operation

  Data is written (recorded) on the tape from memory, via the common trunk. The number of characters written is determined by the NA-TA characters of the cassette unit's control word.

The writing of the data records will not begin closer than 1.3 inches from the BOT mark. Any data written on the tape is subsequently read and checked for validity. After all data has been written and checked, the tape is positioned with the read and write heads in the inter-record gap, the operation terminates and the unit is deselected. A write operation must be terminated by the processor before the tape reaches the transparent trailer (there are 17.7 ±1.2 inches of tape between the EOT mark and the trailer).

Termination

When the specified function has been completed (or earlier if an error is detected), the cassette's control logic sends a terminating status character to the processor which stores it in the cassette unit's control word, where the system's software can examine it to determine what action (if any) is necessary. The bit configuration of the terminating status character depends upon the result of the I/O operation. If the operation is being terminated by the cassette unit, an S3 status character is stored; however, if the processor's I/O Control logic detects an error condition, the S3 status character is inhibited and an S4 status character is stored.

When multiple status conditions occur during the same operation, the different bits representing each of these conditions are included in the S3 status character. Only the "Transmission Error" S3 status character is unique and may not contain bits of any other status character.

There are nine S3 status characters: OPERATION-COMPLETE, READ-ERROR or WRITE-ERROR, SYSTEM-OVERLOAD, END-OF-TAPE, WRITE-LOCKOUT, INOPERATIVE, TAPE-MARK, TRANSMISSION-ERROR, and TIMEOUT.

- The OPERATION-COMPLETE S3 status character (0000 0000) is stored in the cassette unit's control word when the requested function has been completed correctly.

- The READ-ERROR or WRITE-ERROR S3 status character (0010 0000) is stored in the cassette unit's control word when a forward-tape operation has been completed and either (1) the cyclic redundancy check (verifying the success of the read or write operation) indicates an error, or (2) noise bits were sensed in an erased area.

  Upon receiving a latent-error signal from the processor, the cassette unit terminates its current function but sends no further data or requests for data or terminating status characters to the processor's I/O Control; the cassette unit deselects itself.

- The SYSTEM-OVERLOAD S3 status character (0001 0000) is set by the cassette unit and the operation is terminated if the processor's I/O Control does not respond to a request by the cassette for data transmission. All subsequent data to be transmitted to or from the processor is inhibited by the cassette unit's control logic.

- The END-OF-TAPE S3 status character (0000 1000) is set when a backspace function is issued and either the BOT marker is encountered or the tape is between the transparent leader and the BOT mark. During the BOT condi-

tion, the termination of any function except REWIND and REWIND-AND-SET-NOTREADY causes the EOT status bits to be set.

- The WRITE-LOCKOUT S3 status character (0000 0100)° is set by the cassette unit when a WRITE, ERASE, WRITE-TAPE-MARK, REWIND, or REWIND-AND-SET-NOTREADY function is issued and there is no Write Enable plug on the cassette. In the case of WRITE, ERASE, or WRITE-TAPE-MARK, no tape is moved. In the case of REWIND and REWIND-AND-SET-NOTREADY, the function is initiated and the tape is rewound.

- The INOPERATIVE S3 status character (0000 0010) is sent to the processor if the unit enters the not-ready state or if a malfunction occurs after the initiation of the function.

- The TAPE MARK S3 status character (0000 0001) is set if a tape mark is sensed during a READ-RECOVERY, READ, or BACKSPACE operation. No data is transferred to memory.

- The TRANSMISSION error S3 status character (1000 0001) is stored in the cassette unit's control word whenever an error is detected in the transmission of data between the processor and the cassette unit during a write operation. No additional data is requested; the function being performed is terminated. The TRANSMISSION ERROR S3 status character is unique in that all other status bit that may have been set during the operation are suppressed.

- The TIMEOUT S3 status character (0100 0100) is stored in the cassette unit's control word if any function, except REWIND and REWIND-AND-SET-NOTREADY, is issued and no data is detected within three seconds.

S3 status characters are sent to the processor at the following points in the function's execution.

- All functions, except REWIND and REWIND-AND-SET-NOTREADY, are considered completed when the last character in the record is read and verified; at this time the S3 status character is sent to the processor, and the cassette terminates the operation.

- In the case of REWIND and REWIND-AND-SET-NOTREADY, the operation is considered complete when the cassette accepts the command; however, further selection of the unit is inhibited. The cassette is offline during the entire rewind operation.

OPERATION

Normal magnetic tape software for the NCR Century is used to drive the 636 Cassette unit, and for most operating procedures the operator can regard the cassette tape as normal magnetic tape. All existing magnetic tape utility routines (TINIT, GAC, MTPRNT, CPYALT, etc.) may be used with the 636 Cassette unit.

The operator must ensure that there is a 9-track NRZ magnetic tape unit PAL card in his monitor boot for each cassette handler.

The lid of the cassette handler can be used to rewind the cassette manually. When a cassette is placed in the handler, lowering the lid causes the cassette to rewind itself to the beginning of a track. Operators must be aware that raising the lid causes the associated handler to go out of the ready state. If the lid is raised while processing is actually occurring, several things happen (depending upon the activity occurring at the time).

- The READY indicator is turned off and the handler goes inoperative.
- If writing or reading was taking place when the lid was lifted, a normal magnetic tape wait message is output to the operator (probably forcing him to abort the run).
- When the lid is again lowered, the associated handler automatically rewinds back to the beginning of the track; therefore, it would be unwise to lift the lid of a loaded cassette handler during a run, except at orderly halts for cassette changes.

If two cassette handlers are present in the same unit and rewind is initiated on either handler (either manually or by processor control), all activity required on the other cassette handler is held up until the BOT mark has been reached on the rewinding cassette handler.

The standard magnetic tape error and wait messages presently documented in the Operators Information Manual apply to the cassette tape as well.

SPECIFICATIONS

The freestanding low-boy cabinet is 24 inches wide, 28 inches deep, and 44 inches high. The weight of the 636-201 Cassette unit is 500 pounds; the weight of the 636-301 Cassette unit is 187 pounds.

Line voltage is 120 volts ($\pm$12 volts), single-phase, 3-wire. Line frequency is 50-60 Hertz ($\pm$1 Hz). Power consumption is 400 watts.

The temperature range is 68-78 degrees Fahrenheit (dry bulb).

The humidity range is 40-60%, relative.

Tape speed is 7.5 inches per second, recording density is 800 bits per inch, and one track is available for use at any given time.

Each cassette handler reads or writes at a transfer rate of 750 characters per second and rewinds at about 75 inches per second.

Tape cassettes contain approximately 280 feet of tape coated on one side with two parallel recording tracks. Data capacity is 2040 80-character blocks or 984 256-character blocks per track.

Data is recorded in the phase or Manchester mode of recording by bit serially.

All physical and electrical requirements established by ANSI for Magnetic Tape Cassette Information Interchange are met or exceeded.